

Individual Differences

Objectives

By the end of this lesson:

- Students will learn about the attributes of learning that go into making up differences in all individuals.
- Students will compare and contrast different definitions and theories of intelligence.
- Students will explore and gain knowledge of learning styles and how they affect learning.
- Students will learn how creativity contributes to the individual's learning repertoire.
- Students will gain knowledge of how learners develop concepts through determining defining features and attributes and incorporating them into their knowledge base.
- Students will learn how learners, through gaining concepts, make sense of information they can glean from their experiences and knowledge.
- Students will learn the aspects of problem solving in moving from an unresolved situation to overcoming obstacles and reaching a solution.

Introduction

The concept of "intelligence" was something that took considerable refining from the time when Wilhelm Wundt (1832-1920) first postulated that psychological experimentation is something more than a philosophical tenet. He pioneered the concept of stating mental events in relation to measurable reactions. Wundt and other early psychologists were involved in measuring powers of sensory discrimination. This interest with measurement led Wundt to develop the foundation for Binet's first scale of intelligence. Binet had developed a scale correlating specific tasks with levels of ability or a mental age.

Theories and Definitions of Intelligence

Charles Spearman

In the early 1900s, Charles Spearman determined that intelligence is comprised of a single set of reasoning skills known as the **g factor**, along with some other more specific abilities. He believed that to perform a task, the individual had to first use the *g* factor and also involve the specific factor related to that discrete task (McDevitt & Ormrod, 2002).

James McKeen Cattell

James McKeen Cattell (1860-1944) was another pioneer psychologist interested in the study of human intelligence. As a student of Wundt, he used statistical methods to quantify data and helped to develop psychology as an experimental science in America. He was one of the first to stress the importance of quantification of ranks and ratings. An end product of his experimentation with psychological testing was the beginning of mental testing in the psychological laboratory.

Cattell determined that there are two different aspects of general intelligence (*g*). One type of intelligence was deemed **fluid intelligence** (*g_f*). This is considered to be an ability to acquire knowledge quickly and adapt to new situations. A second type of intelligence was deemed

crystallized intelligence (g_c). This type of ability is knowledge and skills accumulated from experiences and schooling. Fluid intelligence seems to relate to quick judgment and decision making with novel tasks, whereas crystallized intelligence depends more on the day-to-day decisions that involve language and the knowledge already gained and in use.

Alfred Binet

Also in the early 1900s, Alfred Binet (1857-1911) was commissioned by the French government to find a way to measure ability so that the government could determine who needed to attend school and who were unable to profit from this experience. Using Spearman's g factor theory, Binet and his associate, Theodore Simon, developed the first individual intelligence test. This test, through many revisions, is still used today. The present form is the Stanford-Binet IV.

It seems to us that in intelligence, there is a fundamental faculty, the alteration or the lack of, which is of the utmost importance for practical life. This faculty is judgment, otherwise called good sense, practical sense, initiative, the faculty of adapting one's self to circumstances. A person may be a moron or an imbecile if he is lacking in judgment, but with good judgment, he can never be either. Indeed, the rest of the intellectual faculties seem of little importance in comparison with judgment (Binet & Simon, 1916/1973, pp. 42-43).

Howard Gardner

A more modern theorist is Howard Gardner (1993), who posited that although there may be that general factor of intelligence, it fails to explain individual performance in difference areas. Gardner identified seven areas of distinct ability:

Linguistic Intelligence	Ability to manipulate language in understanding the rules of grammar. Ability to deal with poetry and prose, be a good negotiator, and have persuasive skills.
Logical-Mathematical Intelligence	Skills with algorithms, mathematical process, and being able to formulate and solve hypotheses.
Spatial Intelligence	Having good revisualization skills, being able to take all information, and with an internal visual image solve problems.
Musical Intelligence	Ability to hear musical relationships internally, learn to read music and play musical instruments, and compose music.
Bodily-Kinesthetic Intelligence	Being able to understand one's position in space; have good balance and antigravity skills; and perform tasks, such as sports or dance, that require good coordination.
Interpersonal Intelligence	Understanding the motives of others, being able to determine others' moods and desires, and using information about others to be able to influence and persuade.
Intrapersonal Intelligence	Being aware of one's self, one's feelings, interests, abilities, and effectiveness.
Naturalist Intelligence	Having an understanding of nature and its patterns, such as how seasons change, how nature reacts to severe trauma (forest fires). Applying knowledge to farming or hunting.

Robert Sternberg's Triarchic Theory

Sternberg looked at intelligence itself. He believed that intelligence is the interaction of three different factors that may come into play, depending on the need and the activity. His three factors are:

1. **Environmental Context:** Individuals may modify the environment to meet their needs, or they may determine a different environment where they may be more successful. He used the act of learning to read to be an adaptation that is important in American culture but may not be at all important in Peruvian culture. In this environmental context, he sees three general skills of importance:
 - a. Practical Problem Solving: Using ability to identify a problem and good reasoning and judgment to solve the problem.
 - b. Verbal Ability: The use of language in speech, reading, reasoning, and persuading.
 - c. Social Competence: Being effective in communication with others and also being sensitive to the needs of others, being compassionate, and having the ability to provide leadership.
2. **Prior Experiences:** Prior experiences are important for both novel and familiar situations. In both instances, previous knowledge and skills will prepare individuals to meet the situations more successfully if they are able to use their prior experiences as information to draw upon to make decisions.
3. **Cognitive Processes:** All individuals have differing sets of cognitive processes. Some are more able to interpret new situations, others may be good at sustaining attention, and still others may be good at finding an alternative solution to a problem. Different cognitive processes are important in different situations. Individuals might perform more effectively in one situation where they have the adequate cognitive processes than they might in another where their skills are not so well developed.

Learning Styles

Learning style is that set of conditions by which an individual prefers to learn. This encompasses temperament, attitude, behavior, and neurological conditions that make some modalities of learning more effective than others. Cultural values or experience might also have affect on learning styles.

Each person can generally identify how he/she prefers to learn. When getting new information, some people would rather have it given to them verbally, others would rather read what they must learn, some prefer charts and diagrams to words, and still others need to have models to manipulate so that they can feel the dimensions of the new learning information. As well, learning style is not static: It changes over time. Conditions that can contribute to this change might be a younger child developing a better ability at reading so that he/she does not need to depend on gaining information in other ways.

Dr. Rita Dunn (2000) developed a rather thorough system for analyzing learning styles and taking into account all of those areas of individuals that might contribute to their learning style development.

- **Environmental:** This attribute of learning refers to such conditions as temperature, sound, lighting, and seating. Just as some individuals need a quiet space, a desk, and good lighting, others might prefer background music, an easy chair, and a lamp.
- **Emotionality:** This attribute is concerned with motivation, responsibility, persistence, and structure. Some people like to work on one thing at a time, going step by step until it is finished. Others are comfortable having several tasks going at one time.
- **Sociological:** This attribute is associated with how an individual learns in relation to other people. Do they prefer to be alone or with peers, an authoritative adult, or a good friend? The pattern or variety of routines is reflected in their learning. Individuals might prefer to learn new tasks alone or with an authoritative adult but work on projects where they have some knowledge with a good friend or in a group.
- **Physiological:** This is the attribute, or strand, of learning that most individuals think of as a learning style. This strand includes
 - ⇒ Perceptual: Visual, auditory, tactile, and/or kinesthetic.
 - ⇒ Time of day: Energy levels differ.
 - ⇒ Intake: Eating, or not, while studying.
 - ⇒ Mobility: Sitting still or moving.
- **Psychological:** This strand is involved with the types of psychological process an individual prefers: right or left brain; impulsive or reflective; and global (preferring having all the information at one time, plus elements of all of the above strands) or analytic (step-by-step process, plus elements of the above strands). These last two elements are rather holistic in nature. Earlier, it was pointed out that learning styles change over time. There are four attributes that differ and have educational implications: (a) global versus analytic processing preference, (b) age, (c) gender, and (d) high- or low-academic achievement (Dunn & Griggs, 1998):
- **Global and Analytic.** When learning new information that is perhaps more difficult, people tend to use one of two processing styles: global or analytic. Learners who prefer the global processing use soft lights and informal seating, take breaks, eat snacks, move around some, and prefer sound to quiet. On the other hand, analytic learners work best with bright lights and formal seating, limited interruptions, a quiet environment, and no snacking. Young children tend to be global processors. This is important information that teachers need to keep in mind in preschool and elementary school.
- **Age.** Learning styles seem to be development and change as individuals mature. The elements that change are:
 - ⇒ Sociological.
 - ⇒ Motivational.
 - ⇒ Responsibility.
 - ⇒ Internal versus external structure.
 - ⇒ Children prefer to work with peers and have an authoritative teacher. Auditory and visual perceptual elements of learning tend to become stronger as children grow and develop.
- **Gender.** Males and females, whether children or adults, seem to learn differently.

Attributes	Male Preferences	Female Preferences
Perceptual	Visual, tactile, kinesthetic	Auditory, quiet
Mobility	More movement	Less mobility
Structure	Informal	Formal
Motivation	Peer motivated and nonconforming	Conforming, authority oriented, and self-motivated

High versus Low Academic Achievement

Children who are achieving at a low level are learning in a different way from those who are high achievers. Teaching strategies that are working for high achievers do not work for those who are not achieving. Part of this is, undoubtedly, the difference in learning styles. Teachers need to keep in mind that students learn better when:

- They can use the learning preferences where they can be successful.
- They can expand the learning style they have and include more modalities.
- Teachers make a point to know their learning styles and accommodate them.
- Teachers use learning activities and materials that will directly include every student's learning style.

Along with students having individual learning styles, teachers also have their specific approaches to teaching that are probably related to their personal learning styles. It is helpful if teachers know not only how the students prefer to learn but also how their teaching style is affected by their personal learning style. Teachers need to learn how to accommodate their preferences to the group of learners they have (O'Connor, 2004). Can you see threads of different theories in this: Piaget? Gardner? Sternberg?

Creativity

To dream and to plan, to be curious about the future and to wonder how much it can be influenced by our efforts are important aspects of being human.

Torrance (1983)

Creativity is not always something teachers are happy to see in their students. Creative thinking can require different abilities from those needed to do very well in academic situations (Renzulli & McGreevy, 1984). J. P. Guilford (1956) talked about the different types of thinking – **convergent thinking**, which can be measured by tests of intelligence, and **divergent thinking**, which is expressed in new, novel ideas that cannot be easily measured by an intelligence test. In the 1960s through to the 1980s, Torrance (1988) developed some measures of creativity in which divergent thinking could be identified. Some of those areas of creativity are listed here:

- Seeing the novel in situations.
- Fluency of thinking with words, associations, or expression of ideas.
- Fluency of thinking (spontaneity or adaptive).
- Originality (seeing remote associations or clever relationships).
- Redefinition (being able to use or see familiar objects in new ways).
- Elaboration.
- Tolerance of ambiguity (willingness to accept uncertainty without rigid categories).
- Interest in convergent thinking (using pieces to seek a solution to a math problem).
- Interest in divergent thinking (open minded, open-ended thinking where there is no particular right answer)

Some activities that can be used in schools to foster creative thinking in learners include:

- Encouraging **intrinsic motivation** by allowing learners to pursue an activity for its own sake, not for a grade or reward.
- Fostering **independence** by allowing learners to perform a task without the likelihood of critical review.
- Giving **choice** by allowing learners to choose what and how they want to learn.
- Providing **inspirational models** by having creative people come into the class and provide models or become mentors.
- Providing **stimulating** experiences that challenge cognitive and perceptual boundaries.
- Promoting **persistence** by encouraging and allowing second chances at efforts still in progress or which may have failed.
- Allowing **mistakes** to let a learner know that it is all right to take risks and try another way to reach a solution

Concept Formation

Are you beginning to see how related all of the topics in this lesson are? They also are related to some of the topics in other lessons. Try to see those comparisons and relationships as you continue to study and learn. **Concept formation** is one of those areas closely related to all of the previously mentioned topics. Without having intelligence, a way to get information in, and some degree of creativity, forming new sets of concepts cannot happen. In order to form concepts, an individual must have some basis of knowledge; be able to take in information and organize it; add the new ideas to already known information; and form new thoughts, ideas, or concepts.

So, what is a concept? A concept is a set of ideas, abstractions, or attributes of things. For example, if one were to hear the word *train*, what would come to mind? Whatever comes to mind is based on the experience of the people themselves. *Train* could bring to mind a locomotive, a long group of cars on a track, or a wagon train. It could cause someone to think of how to *train* a dog. Whatever the person thinks of, it usually allows a person to then make inferences about new information learned about the concept. Another example might be of a young child who has read *The Little Engine That Could*. The child has an idea of what that *train* engine looks like, as well as the fact that it runs on tracks. So, when he/she sees or is introduced to a different train, forming the new concept will be based on that previous knowledge. The child will then learn that there are other types of trains.

As stated in the textbook, concepts have defining features that must be present to qualify them in that concept. An example is a *chair*, which has features about it that make it chair-like: four legs, a back, a seat, something to sit on. It may also have other features that are different, but it has those defining features that classify it as a chair. A chair is also part of a broader concept: It is furniture. All of these concepts are available to the learner's senses. They can see and hear a train; they can see and feel a chair. However, some of the concepts that begin to cause difficulties are such abstractions as *freedom*, *loyalty*, *honesty*, and, *justice*. These are concepts that can cause real learning problems for students in school. Concept formation and development are dependent on the individual's language system and neurological integrity. The question may be: How able is the individual to grasp these ideas and formulate them into mental concepts to be usable during a reading assignment?

Teaching concepts takes time and planning. To assure that students are ready to form new concepts, teachers need to be assured that they provide the vocabulary needed, give many examples, have visuals available whenever possible, and help students relate the new information to already stored information.

Reasoning

Again, closely related to the other topics in this lesson, reasoning is that ability to take information into consideration and formulate a conclusion or belief. Reasoning is at the other end of the spectrum from memorizing. Many students try to memorize information in order to pass tests. They are not looking to learn and use that information in the future. Other students look at the information and see answers, conclusions, or information that makes good sense to them. When they commit their information to memory, it will be a reasoned result that is much more likely to be usable information in the future. When arriving at conclusions, individuals seem to have two different styles in their approaches: **deductive reasoning** and **inductive reasoning**.

Type of Reasoning	Characteristics
Deductive Reasoning	<p>Starts with a general hypothesis and works to a specific. A confirmation that proves the hypothesis is arrived at. A deductive argument offers at least two assertions that lead to a conclusion. These arguments are usually phrased as "syllogisms," or mathematical statements, where the assertions lead to the conclusion. If the first two statements are true, then the confirmation or conclusion must be true. Deductive reasoning is not true or false, but sound or unsound, based on how valid the facts are in the assertions. The goal is to test a hypothesis from already gathered information.</p> <p style="text-align: center;">Examples</p> <p>Premise: All horses have four legs. Premise: Barney is a horse. Confirmation: Barney has four legs.</p>

Inductive Reasoning	Moves from specific facts to broad generalizations or theories. This process begins with making specific observations or measurements; looking for specific patterns, directions, or rules; formulating a hypothesis; and then developing a theory or conclusion. Open mindedness and being interested in exploring with no known outcome are important. This process requires gathering information into a meaningful unit in order to draw conclusions.
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Problem Solving

Problems are only opportunities in work clothes

Henri Kaiser

<http://www.leadershipnow.com/probsolvingquotes.html>

The final topic in this lesson is one that involves all of the other topics in order to reach resolution. One definition of problem solving is recognizing the existence of a problem, being able to identify the parameters of the problem, determining what needs to be done and doing it, and then evaluating the outcome of the action. When following all of these steps, an individual would need to use all of the topics previously discussed: (a) recognizing and defining the problem (intelligence), (b) evaluating all of the aspects of the environment that might help with the problem (learning style), (c) thinking of ways that might be unique to being able to solve the problem (creativity), (d) comparing all the information at hand and getting new ideas (concept formation), (d) taking all possible avenues and determining the best combination of ideas (reasoning), and (e) coming up with a good solution (problem solving). The following Web site has a thorough, reasonable look at creative, problem-solving techniques. Michael Eisenberg and Robert Berkowitz (1995) formulated an information problem solving strategy known as "The Big Six," which represents the six steps involved in the process. The following table of sequential steps represents their conceptualization of problem solving.

The Big Six Skills

There are six broad skill areas necessary for successful information problem-solving:

Task Definition	Define the task (the information problem). Identify the information needed to complete the task.
Information-Seeking Strategies	Brainstorm all possible sources Select the best source
Location and Access	Locate sources Find the needed information within the source
Use of Information	Engage in the source (read, hear, view, touch) Extract relevant information
Synthesis	Organize information from multiple sources Present the information
Evaluation	Judge the process (efficiency) Judge the product (effectiveness)

The course textbook is a good resource for strategies for problem solving (pp. 324-327) and impediments to problem solving (pp. 327-328). An important point to remember is that problem solving comes from all of the skills described in this lesson and that the solution is no better than the effort put into finding it.

**Whatever failures I have known, whatever errors
I have committed, whatever follies I have witnessed
in public and private life, have been the consequences
of action without thought.**

Bernard Baruch

<http://www.leadershipnow.com/probsolvingquotes.html>

Summary

People are complex, and there are multiple theories and evidence as to what are the prevailing aspects of psychological differences. Every learner is unique. Labeling students as disabled, average, or gifted make broad assumptions about the similarities of learners within categories (i.e., missing the differences) and about the differences between learners across categories (i.e., missing the similarities).

The kinds of learning for which each brain network is specialized demand different approaches to teaching. No two learners have the same set of neurological pathways that represent their

learning network. Individuals see problems or learning situations differently, react as to how they will approach that challenge, and then set about problem solving with highly unique methods.

Implications for Teaching

In the classroom, the teacher must find ways to assess each student and attempt to determine the individual differences that exist therein. Although mass instruction can be done with all students, discrete methods must be available for those who use different approaches to learning. Teachers must provide:

- Active models of skilled performance – Many learners need the visual models of how a task is performed.
- Scaffolds to support the learner – Building information on what is already known and experienced helps it to become a usable learning component.
- Ample opportunities to practice – Watching something done is one thing; being able to spend time practicing is the best tool for new learning and to maintain already learned material.
- Ongoing, immediate, and relevant feedback – A step that too many teachers short change, it is absolutely necessary if the student is to have confidence in proceeding to a new step.
- Opportunities to demonstrate skill – Being able to demonstrate and teach others is a high-level learning skill.

Lesson References

Binet, A., & Simon, T. (1916). *The development of intelligence in children*. Baltimore, Williams & Wilkins. (Reprinted 1973, New York: Arno Press; 1983, Salem, NH: Ayer Company). The 1973 volume includes reprints of many of Binet's articles on testing.

Creative problem-solving techniques. Retrieved February 20, 2004, from <http://www.mudvalley.co.uk/collateral/content/77.htm>

Dunn, R. (2000). Learning styles: Theory, research, and practice. *National Forum of Applied Educational Research Journal*, 13(1), 3-22.

Dunn, R., & Griggs, S. (1998). Learning styles: Link between teaching and learning. In R. Dunn & S. Griggs (Eds.), *Learning styles and the nursing profession* (pp. 11-23). New York: NLN Press.

Eisenberg, M. B., & Berkowitz, R. E. (1995). The six study habits of highly effective students: Using the big six to link parents, students, and homework. *School Library Journal*, 41(8), 22-25.

Eisenberg, M. B., & Johnson, D. (1996, March). Computer skills for information problem-solving: learning and teaching technology in context, *ERIC Digest*. Syracuse, NY: ERIC Clearinghouse on Information & Technology. Retrieved February 20, 2004, from http://www.itrc.ucf.edu/webcamp/final_projects/barney/big6.html

Gardner, H. (1993). *Multiple intelligences: The theory in practice*. New York: Basic Books.

Guilford, J. P. (1956). Structure of intellect. *Psychological Bulletin*, 53, 267-293.

Human intelligence: Biographical profiles. (2003). Indiana University. Retrieved February 15, 2004, from <http://www.indiana.edu/~intell/plato.shtml>

Information Problem Solving: The Big Six. (1998). *Investigating Earth*. Retrieved February 20, 2004, from <http://www.jlhs.nhusd.k12.ca.us/Classes/Science/Research.html>

Leading thoughts: Building a community of leaders. (2003). Retrieved February 11, 2004, from <http://www.leadershipnow.com/probsolvingquotes.html>

Learning styles. (1998). Retrieved February 20, 2004, from <http://www.chaminade.org/inspire/learnstl.htm>

McDevitt, T. M., & Ormrod, J. E. (2002). *Child development and education*. Upper Saddle River, NJ: Merrill/Prentice Hall.

O'Connor, T. (2004). *Using learning styles to adapt technology to higher education*. Indiana University. Retrieved February 14, 2004, from <http://www.indstate.edu/ctl/styles/learning.html#STYLES>

Renzulli, J. S., & McGreevy, A. M. (1984). *A study of twins included and not included in gifted programs*. Storrs: University of Connecticut, School of Medicine.

Sadow, S.A. (1983). Creative problem-solving for the foreign language class, *Foreign Language Annals* 16, 115-20.

Solomon, B. A., & Felder, R. (n.d.). *Index of learning styles questionnaire*. North Carolina State University. Retrieved February 14, 2004, from <http://www.leadershipnow.com/probsolvingquotes.html>

Torrance, E. P. (1988). The nature of creativity as manifest in its testing. In R. J. Sternberg (Ed.), *The nature of creativity: Contemporary psychological perspectives* (pp. 43-75). Cambridge, UK: Cambridge University Press.

Lesson Glossary

- **Quantification:** The act or process of measuring anything by using a numbering or other system that is structured and systematic. For example, we know the temperature by using a scale of Centigrade, Fahrenheit, or Celsius.
- **Antigravity:** Those acts that can be achieved by defying the pressure of gravity. In young children, this may be expressed by learning to do activities in a vertical position and balancing on one foot, jumping with both feet off the ground, and going up and down steps by lifting one foot off the floor.
- **Modalities:** Those systems by which the individual takes information into the sensory system. Generally, in a learning environment, these are auditory, visual, tactile, or kinesthetic.